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Eric Paulson, Wendel M. Burkhardt, Steve Mysko, Tim Jenkins

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Air Force Research Laboratory (AFMC)
AFRL/PRST
4 Draco Drive
Edwards AFB CA 93524-7160

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Air Force Research Laboratory (AFMC)
AFRL/PRS
5 Pollux Drive
Edwards AFB CA 93524-7048

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Eric Paulson (AFRL/PRST); Wendel M. Burkhardt, Steve Mysko & Tim Jenkins (all Advatech Pacific, Inc.), "Simplified Liquid Rocket Engine Performance and Weight Model"

2003 JANNAF CS/APS/PSHS/MSS Subcommittee Meeting **(Statement A)**
(Colorado Springs, CO, 1-5 Dec 2003) (Deadline: 17 Apr 2003 – PAST DUE)

December 2003 CS / APS / PSHS / MSS

ABSTRACT SUBMITTAL FORM

Unclassified Abstract

(250-300 words; do not include figures or tables)

The Air Force Research Laboratory is developing a tool to analyze liquid propellant launch systems. This tool, called Integrated Propulsion Analysis Tool (IPAT), requires the capability to predict the weight of the vehicle components as well as the performance of the rocket engines.

For IPAT, a simplified model was developed to predict liquid rocket engine (LRE) performance and weight. The LRE model was developed to be very flexible and model a wide variety of rocket engines. The model allows the user to select the propellants used for the fuel and oxidizer from a list that includes hydrogen, hydrocarbons such as RP-1, storable propellants, and oxygen. The user can select the engine power cycle from a list that includes expander, staged combustion, gas generator, and pressure fed. Other parameters used by the model include engine thrust, chamber pressure, overall engine mixture ratio, nozzle exit area ratio, and materials of manufacture.

The model uses a combination of physical relationships and weight correlations to calculate the weight of individual rocket engine components. The model predicts liquid rocket engine performance using combustion gas properties provided by the Chemical Equilibrium with Applications (CEA) computer code. This paper will describe the analysis approach used in the model and show comparisons of weight predictions to actual flight rocket engines.